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DIRECTORATE OF INTELLIGENCE

27 FEB 1985

MEMORANDUM FOR: David Mack
Director, NEA/ARN
Department of State

FROM: [redacted] 25X1
Chief, Near East Branch
Geography Division, OGI 25X1

SUBJECT: Israeli Water Practices in the Yarmuk Triangle [redacted]

1. The attached memorandum presents our assessment of Israeli water diversion from the Yarmuk River for use in the Yarmuk Triangle and for storage in Lake Tiberias. Please note that some of our conclusions are still tentative because of inconsistencies in the available evidence. We plan to continue working on these areas and hope that by identifying information gaps this paper will assist in further collection efforts. [redacted] 25X1

2. Our key judgments are that the Israeli demand for a guaranteed flow of 2.3 cubic meters per second from the Yarmuk River during summer is in excess of present needs and greater than the present capacity of the Israeli pump stations on the Yarmuk River. We believe that Israeli tactics to limit Jordanian water use are intended principally to preserve Israel's option to increase its use of Yarmuk River water in the longer term. [redacted] 25X1

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Attachment: 25X1
The Yarmuk Triangle: Israeli Water Practices [redacted] 25X1
GI M 85 10018 February 1985 [redacted] 25X1 25X1

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SUBJECT: Israeli Water Practices in the Yarmuk Triangle [redacted] 25X1

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The Yarmuk Triangle: Israeli Water Practices

Summary

We believe that Israeli tactics in the dispute with Jordan over water use in the Yarmuk Triangle are designed to maximize Israel's long-term access to Yarmuk River water. During years with low or normal rainfall, Israeli pumping from the Yarmuk is estimated at about 60 million cubic meters (mcm) annually, but the capacity for pumping more than 100 mcm is in place. If the Israeli-proposed canal from the Yarmuk to Lake Tiberias were built, we believe Israel's annual take would increase to about 150 mcm. 25X1

We estimate that the water requirement for Israeli activities in the Yarmuk Triangle is between 35 and 40 mcm annually. The maximum rate of flow to supply the entire area during the peak summer months is about 2.0 cubic meters per second (cms) of which we believe about half is drawn from the Yarmuk and half from Lake Tiberias during normal years. Israel's demand for 2.3 cms from the Yarmuk in summer is therefore in excess of actual needs. The demand is also greater than the reported capacity of its pump stations that operate on the Yarmuk during the summer. 25X1

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This memorandum was prepared by [redacted] Geography Division, 25X1
Office of Global Issues. The information herein is updated to 2 January 1985. Comments and questions may be addressed to [redacted] Chief, Near East Branch, Geography Division, 25X1
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The Yarmuk Triangle: Israeli Water Practices

Introduction

Disagreement between Israel and Jordan over the amount of water to be supplied from the Yarmuk River to Israel's Yarmuk Triangle has been one of the issues preventing a comprehensive water-sharing agreement during the last 30 years. Although the two sides have agreed that Israel is entitled to an annual allocation of 25 million cubic meters (mcm) from the Yarmuk, dispute continues over Israel's demand for a specific flow rate of 2.3 cubic meters per second (cms) during the summer months and over Israel's capture of additional winter flows.

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Present Water Needs and Usage in the Yarmuk Triangle

Israel's Yarmuk Triangle has a total area of about 28,000 dunams,[1] of which approximately 22,000 dunams are being used for irrigated agriculture.[2] This figure,

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is slightly smaller than the 25,000 or 26,000 dunams of agricultural land in the Triangle reported in most basic sources

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[1]Also called the Adasiya Triangle. The Triangle is here defined as the area bounded by Lake Tiberias, the Jordan River, the Yarmuk River and the 1949 Israel-Syria Armistice line. One dunam equals 1/10th of a hectare.

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[2]Urban areas cover about 3,000 dunams, and roads, ditches, fortifications, and unused areas, largely along the rivers, comprise another 3,000 dunams.

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since the 1950s, but is twice as large as the 11,000 dunams cited in the 1953 Unified Development Plan. The main crops, in order of importance, are bananas, citrus fruits, corn, alfalfa and other fodder crops, and date palms.

Estimated Irrigation Water Requirements

We believe the annual water requirement from all sources for irrigation of crops in the Triangle, under current land use, is approximately 36 mcm per year.

The resulting water use figures, although approximate, indicate that some irrigation is practiced year round and therefore suggest that water may be pumped into the Triangle from pump stations on the Yarmuk throughout the year. Table 1 also shows that the major crops grown in the Triangle are relatively heavy users of water. On average--because of the high proportion of bananas and alfalfa--they require 50 percent more water per dunam than is required by the combination of citrus fruit, field crops, and vegetables grown by Jordan in adjacent areas of the Jordan Valley.

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[1]Because data on crop water requirements were not available for the Triangle, we used water requirement factors developed by the Harza Overseas Engineering Company for the adjoining area of the Jordan Valley in Jordan. The estimates, therefore, may be slightly too high, because rainfall is slightly greater in the Triangle. The irrigation system's efficiency was estimated to be 75 percent. If the system has an efficiency of 80 percent, the Triangle would require only 34 mcm rather than 36 mcm per year.

TABLE 1

Crop Water Requirement in the Triangle

Cubic meters Per Dunam (cm/dunam)

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Bananas	47	70	106	173	247	301	330	317	274	203	117	57	2,242
Field Crops[1]	20	67	95	190	195	210	195	225	215	165	55	20	1,625
Citrus & Dates	15	39	49	102	136	164	173	165	137	110	60	11	1,165

Million Cubic Meters (mcm)

Crop	Dunams[2]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Bananas	6,200	.29	.43	.66	1.07	1.53	1.87	2.05	1.97	1.70	1.26	.73	.35	13.91
Field Crops	9,050	.18	.61	.86	1.72	1.76	1.90	1.76	2.04	1.95	1.49	.49	.18	14.94
Citrus & Dates	6,250	.09	.24	.31	.64	.85	1.03	1.08	1.03	.86	.69	.38	.07	7.27
Total	21,500	.56	1.28	1.83	3.43	4.14	4.80	4.89	5.04	4.51	3.44	1.60	.60	36.12

Cubic Meters Per Second (cms)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
.21	.53	.68	1.32	1.55	1.85	1.83	1.88	1.74	1.28	.62	.22

[1]Field Crops are primarily corn (2 crops per year) and alfalfa.

[2]Does not include 500 dunams of ponds which probably require about 1 mcm annually.

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Estimated Domestic and Industrial Water Requirements

Water requirements for purposes other than irrigation and fish ponds in the Triangle probably total between 1 and 2 mcm annually. The domestic (household) requirement, using the Israeli average consumption of 250 liters per day, would total 0.5 mcm annually for the population of about 6,000 persons. Industrial requirements are estimated here to be roughly 1 mcm annually because the Triangle has a large plywood factory and several food-processing industries that are heavy water users; if based on the Israeli per capita average, they would be even smaller. According to an Israeli Government report, the plywood factory used 0.5 mcm in 1972. The water requirement for livestock consumption is insignificant.

Israeli Reporting on Water Usage in the Triangle

Israeli data on water consumption in the Triangle are not consistent with our understanding of the area's water requirements as presented above. Recent Israeli claims concerning total water use in the Triangle tend to be larger than our estimate of 35 to 40 mcm annually, partly because the Israeli-claimed totals include water used in areas adjoining the Triangle west of the Jordan River and along the eastern shore of Lake Tiberias.

According to the Israelis, water use in the Triangle has increased sharply since the 1950's. The 1953 Main Plan allowed for an annual supply to the area of 17 mcm, and a US official involved in discussions with Israel claimed that usage in the

Triangle was 12 to 15 mcm in the late 1950s. During meetings with Ambassador Johnston in 1955, Israeli negotiators claimed usage was 39 mcm annually; another senior official claimed usage was 25-30 mcm in 1958, but that future demand would be 40 mcm; in 1970 an Israeli official said total water use was 40 mcm; in 1977 and 1984 Israeli officials claimed current usage had increased to 50 mcm per year.

Analysis of the Israeli Water Supply System Associated With the Triangle

The primary sources of water for the Triangle are the Yarmuk River, the Jordan River, and Lake Tiberias. From a series of pumping stations water is carried by a modern irrigation network to agricultural fields in the Triangle, south to the Bet She'an area, and west to the Yavne'el Valley. The surplus water pumped from the Yarmuk during the winter is piped north to Lake Tiberias for storage until the following dry period.

The most detailed description of the system supplying water to the Triangle was provided by an Israeli water official, Yaacov Vardi, to US Embassy officials in late 1977. According to Vardi, 18.2 mcm was provided from three pump stations on the Yarmuk, 23 mcm from two pump stations on the Jordan, 1.2 mcm from a pump station on Lake Tiberias, and 9.3 mcm from the Deganya-Bet She'an pipeline (maps and figures 1-3). the small Tiberias pump station is actually more than a kilometer east of the Triangle and one of the two Jordan River pump stations is on

the west side of the river from where it probably supplies irrigation water to crop land west of the Triangle. The remaining pump stations identified by Vardi were described as supplying a total of 40 mcm to the Triangle annually.

Pumping from the Yarmuk River

According to Vardi, Israel's three pump stations on the Yarmuk river had combined capacity of 2.1 cms in 1977 (table 2). He claimed that there were no plans to increase this pumping capacity, and

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According to our estimates of Triangle water requirements (table 1) this flow capacity (if fully used) would be adequate to supply the entire Triangle with water year-round, including the peak summer season. Assuming an adequate water supply in the lower Yarmuk, local users would presumably prefer Yarmuk rather than Lake Tiberias water because it has a lower salt content. The lack of "surplus" water supplies in Lake Tiberias might also be a factor in most years, although in years with high rainfall substantial amounts of Tiberias water are released to the lower Jordan River. These factors suggest that the three Yarmuk pump stations might supply the entire Triangle requirment of 35-40 mcm annually during years when the level of Lake Tiberias is low.

TABLE 2

Pump Stations, Yarmuk Triangle Area

Pump Station	Year Built	Output Capacity cm/sec	cm/hr	mcm yr	Annual Production
From Jordan River					
Deganya	1962/63				69.3
To Bet She'an		2.4	**8,800**[1]	77.1	**50.0**[2]
To Yarmuk Triangle					**9.3**
To Yavne'el Valley		.6	**2,000**	17.5	**10.0**
Jordan Valley District	1950's	1.7	**6,100**	53.4	**23.0**
West	(est.)	.8	**2,800**	24.5	11.0
East		.9	**3,300**	28.9	12.0
Yarmuk River to Triangle	1950's	2.1	**7,600**	66.6	**18-25**
Massada-Sha'ar Ha Golan		0.5	1,800	15.8	5
Yarmuk		1.0	3,600	31.5	9
Ashdot Ya'aqov		0.6	2,200	19.3	6
Yarmuk River to Tiberias					
Naharayim	1977/78	4.2	**15,000**	131.4	**40**[3]
Total to Yarmuk Triangle					39.3-46.3
Total from Yarmuk River					58-65

[redacted]

[2]May-November through 48" pipeline; December-April through 16" line only.

[3]December to April.

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the three stations' combined output was 20 mcm in 1957, 24.9 mcm in 1963 (cited as average), 22 mcm in 1964, and 18.2 mcm in 1977. (the remaining 15 to 20 mcm for the Triangle presumably was obtained from Lake Tiberias)

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in 1964, pumping rates averaged 1.84 cms during three months and 1.7 cms during the "remaining" three months, for a yearly total of 24.9.[1] In May 1984, in discussions with Jordan, the Israelis demanded Yarmuk River flow rates of 1.0 to 2.3 cms during seven months and noted that amounts for the other months could be talked about later (table 3).

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Table 3

Israeli Flow Rate Demand 1984 (CMS)

May	Jun	Jul	Aug	Sept	Oct	Nov
1.8	2.0	2.3	2.3	1.8	1.0	1.0

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[1]These monthly and annual figures are not consistent. Pumping at a rate of less than 1.4 cms would yield a total of 24.9 mcm in 7 months.

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The flow rate demand in table 3 translates into a total potential withdrawal of 32 mcm for the seven months. The actual river flow rate for the period was set at about 1.8 cms, which would have provided 33.3 mcm if all the available river water was pumped for the entire 7 months. The maximum monthly demanded flow rate of 2.3 cms is inconsistent with another Israeli statement, cited above, that the three pump stations on the Yarmuk have a maximum combined capacity of only 2.1 cms.

the three pump stations on the Yarmuk provide about one half of the Triangle's annual water requirement of 35-40 mcm. This, in conjunction with the monthly irrigation water requirements in table 1, indicates that the three Yarmuk pump stations' output during the peak summer months is about 1.0 cms, considerably less than the 1.7 or 1.8 cms commonly reported, and less than half the flow rate demanded by Israel from Jordan.

An alternative interpretation of the data, which we believe is less plausible, under-reported their annual pumping from the three Yarmuk stations and are maximizing their use of Yarmuk water. This scenario assumes that the pipeline network from the Yarmuk pump stations is linked to

the Bet She'an pipeline and/or to Lake Tiberias. Under this scenario the Yarmuk pump stations provide water for all or most of the Triangle in the summer and to Lake Tiberias or other areas outside the Triangle in winter. Total annual pumping from the three stations could amount to almost 60 mcm annually, assuming a pumping rate of 2.0 cms during the five winter months and 1.7 cms during the remaining seven months.[1] 25X1

Yarmuk River-Lake Tiberias Pumping Operations

Between 1959 and 1963, Israel built a large pump station at Deganya on the Jordan River at the outlet from Lake Tiberias (figure 6) and a system of pipelines leading south to Bet She'an, to the Yavne'el Valley, (southwest of Lake Tiberias) and into the Yarmuk Triangle. The Bet She'an and Yarmuk Triangle portions of the system were intended to supply water to those areas from Lake Tiberias in anticipation that Jordan would begin using the Yarmuk's entire summer flow when the East Ghor Canal began operation in 1962. In 1959 and 1963 Israeli officials stated to US Embassy officals that they were willing to take their claimed allocation of 40 mcm from the Yarmuk during the winter by using the three Yarmuk pump stations to transfer Yarmuk water into Tiberias. The Yarmuk pump stations were reportedly connected to

[1]Hypothetical pumping rate of 2.0 cms in winter is slightly less than reported pump capacities; 1.7 cms rate in summer is slightly less than estimated average stream flow. 25X1

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the Deganya-Bet She'an pipeline to permit this water transfer during the high water season. Nevertheless, since 1963 Israel has continued to demand a guaranteed share of the Yarmuk during the low water season.

Naharayim Pumping Station

In the 1970s Israel revealed new plans to make fuller use of the Yarmuk's winter flow that bypassed the East Ghor intake. In late 1977 Israel completed work on the first stage of a large pump station on a canalized portion of the Jordan River to draw water from the Naharayim Reservoir on the Yarmuk (figure 7). the project's first stage was capable of pumping 25 mcm annually to Tiberias.

The water from Naharayim passes through the 48-inch Deganya-Bet She'an pipeline to Lake Tiberias from December through March when water requirements are low in the Bet She'an area, During this period when the flow of the pipeline is reversed, the needs of the Bet She'an area are met by a 16" pipeline that was built parallel to the larger pipeline. the installation of additional pumps at the Naharayim station increased the station's capacity to 40 mcm during the four-month operating period. In especially wet years, such as 1980-81, when Lake Tiberias was completely filled from natural inflow, the Naharayim pumps were used for only a short time in December.

It is conceivable that in some years the Naharayim pumping system may operate for slightly longer than the four months [redacted]

[redacted] During some of the remaining eight months,

particularly in April but also during parts of May and November, large amounts of the Yarmuk's flow bypass the three Yarmuk pumping stations and enter the Naharayim Reservoir. It seems likely that any pumping from Naharayim during this period would be sent southward in the 48 inch pipeline to Bet She'an. At least theoreticaly, extension of the Naharayim pumping operation for a month or two during wet years would permit the pumping of an additional 10 to 20 mcm annually. [redacted]

The Planned Yarmuk-Tiberias Canal

The Israelis and other planning groups working in the area recognized from early on the utility of a canal to transfer Yarmuk water for storage in Lake Tiberias. Indeed, the planning for Jordan's East Ghor Canal in the 1950's provided for the construction of the canal's intake structure at a point on the Yarmuk where the river's elevation is above the level of Lake Tiberias. This feature, which was in conformity with the Johnston Plan, allowed for the possible future construction of a gravity flow canal leading from a planned weir at the intake to Lake Tiberias. The Plan foresaw that the water stored in Tiberias would be for the use of Jordan. Since the East Ghor Canal was completed in 1961, no serious attention has been given to storing Yarmuk River water in Tiberias for Jordan. In late 1967, however, the Israeli press reported that Israel was

considering plans to build a canal to Tiberias to capture a larger share of the Yarmuk's winter flow for use in Israel. [redacted]

The proposal to build a canal to Lake Tiberias from a diversion weir at the intake became an issue during discussions between US representatives and Israeli and Jordanian officials regarding the Maqarin Dam project on the Yarmuk River. The effort between 1976 and 1980 to reach agreement on the Maqarin Dam eventually foundered on several issues--including Jordan's refusal to engage in direct talks with Israel and the deterioration of Jordanian relations with Syria. The most intractable problem, however, was Israel's demand to link construction of the diversion weir to the provision of as much as 140 mcm of the Yarmuk's flow to the occupied West Bank. Jordan rejected this demand on the grounds that it could not make such an arrangement outside an eventual overall political settlement with Israel. [redacted]

According to Israeli officials participating in the 1979 and 1980 discussions, there was only one situation under which Israel would consider construction of the weir without agreement on a quantity of water for the West Bank: if Jordan would agree that Israel could construct a canal from the Yarmuk to Tiberias in conjunction with building the weir. Apparently no mention was made of how much water would be diverted to Lake Tiberias through the canal. [redacted]

Beginning in 1981, [redacted] planning was under way to lower Lake Tiberias by 1 meter to create an additional 160 mcm of storage capacity to accomodate

[redacted]

additional water "from the Yarmuk and rainwater".[1] Part of the plan called for an additional pump to be installed at the Lake Tiberias end of the National Water Carrier so that additional water could be pumped into Israel's aquifers. In April, 1984, a contract to supply the new pump was signed with a Swiss firm, according to Israel's water commissioner, quoted in the press. Installation of the new pump was to be completed by late 1985, although recent press reports have noted that funding is not available for the project. Presumably lowering of the lake by the full meter will not take place unless progress is made on additional means for obtaining water from the Yarmuk River. Lowering of the lake level by about a half-meter would seem to be called for in any case to provide room for heavy inflow during wet years that until now have been released into the lower Jordan River.

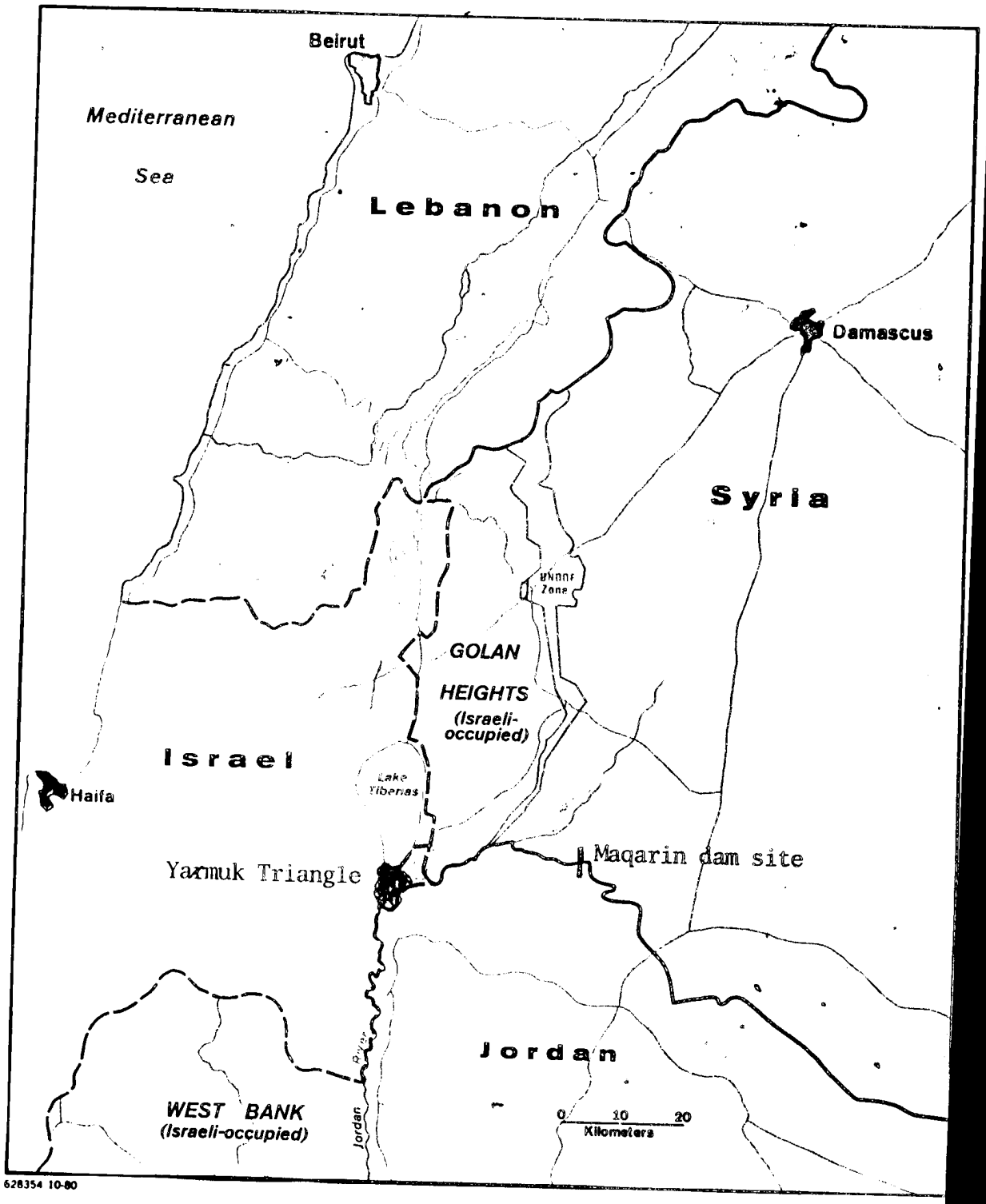
The issue of the permanent weir on the Yarmuk and a canal to Lake Tiberias took on a new dimension in July 1984 when Israeli negotiators gave Jordan a blueprint for the proposed facility. The Israeli plan provided for a maximum flow rate of 16 cms into Jordan's East Ghor Canal (although it has a 20 cms capacity) and a maximum of 25 cms into the canal to Lake Tiberias. For comparison purposes, the average rate of Yarmuk River flow in

[1]At the present time, because of high salinity at depth, water is only drawn from the lake's top 3 meters. Hence, the present operational storage volume of the lake is only about 500 mcm.

February, the wettest month, was about 30 cms from 1953 to 1976. In most years the average February flow rate ranged between 15 and 45 cms.

These Yarmuk flow figures, alone, provide little indication of the actual amounts of water that are envisioned for Jordan and Israel under the Israeli plan. The capacity of the Israeli canal would theoretically allow Israel to divert to Tiberias most of the 200 mcm or so of Yarmuk river water that is not now used by Syria and Jordan.[1] Practically, if Jordan agreed to construction of this facility, Israel would probably allow Jordan to divert a larger share than it is presently able to take from the Yarmuk. On balance, we believe that Israel's objective is to acquire roughly 150 mcm annually via a new canal, and at the same time realize a substantial savings in electricity cost by closing its present pump stations.

[1]The estimate of 200 mcm of unused flow annually is a rough average. Actual Yarmuk River flows past the East Ghor Canal probably range between 100 and 400 mcm per year.



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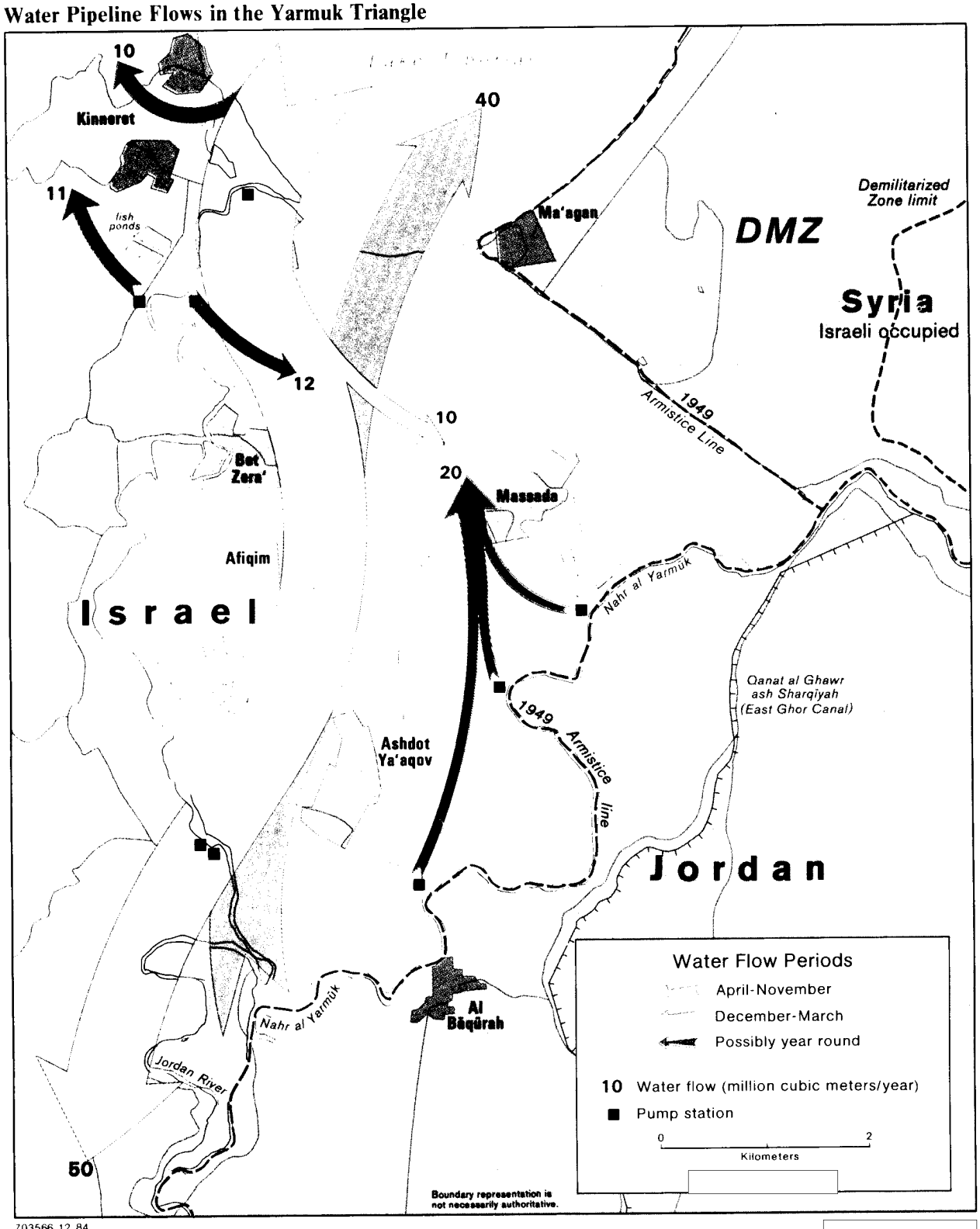
Water Pipeline Flows in the Yarmuk Triangle



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